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A New Species of *Metacypris* (Crustacea: Ostracoda: Cytheroidea: Limnocytheridae) from Hokkaido, Japan

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A new species of the freshwater ostracod genus *Metacypris* is reported from Kushiro Marsh, Hokkaido, Japan. Two large posterior brood chambers in the females give this species a perfect heart shape in dorsal view. The male is characterized by a digit-shaped plate on each hemipenis. This is the second living species of *Metacypris* to be described; the other species, *M. cordata* Brady and Robertson, 1870, is restricted to Europe. Furthermore, this new species of *Metacypris* is only the second endemic freshwater cytheroidean species so far reported from Japan and the first record of the family Limnocytheridae in Japan.

Key Words: *Metacypris*, Limnocytheridae, Ostracoda, Hokkaido, Japan.

Introduction

There are over 130 species of *Metacypris* recorded worldwide from the Cretaceous to the Recent (Kempf 1980, 1997). Among these, only one living species has been described, *M. cordata* Brady and Robertson, 1870, which is also known from fossil deposits of Pleistocene age. *Metacypris cordata* is widespread, although not common, in Europe (Colin and Danielopol 1980; Meisch 2000).

Sampling in the Kushiro Marsh has recently yielded a second living species of *Metacypris*. The Kushiro Marsh is located within Kushiro Shitsugen National Park, eastern Hokkaido (Fig. 1) and is the largest marshland in Japan. It covers an area of 269 km², which is 60% of the total area of Japan's freshwater wetlands. The marsh has an elevation of less than 10 m and is covered with a layer of peat 1 to 3 m thick.

The description of this new species and an outline of its ecology are the subjects of this paper.

Material and Methods

Sampling was undertaken on 22 July 2000 and 5 August 2001. The appendages were mounted in glycerin on glass slides with cover slips sealed with an acryloid B72 varnish (ethyl methacrylate copolymer) and were drawn with the aid of a camera lucida. Carapaces were mounted on stubs and sputter-coated with gold prior to

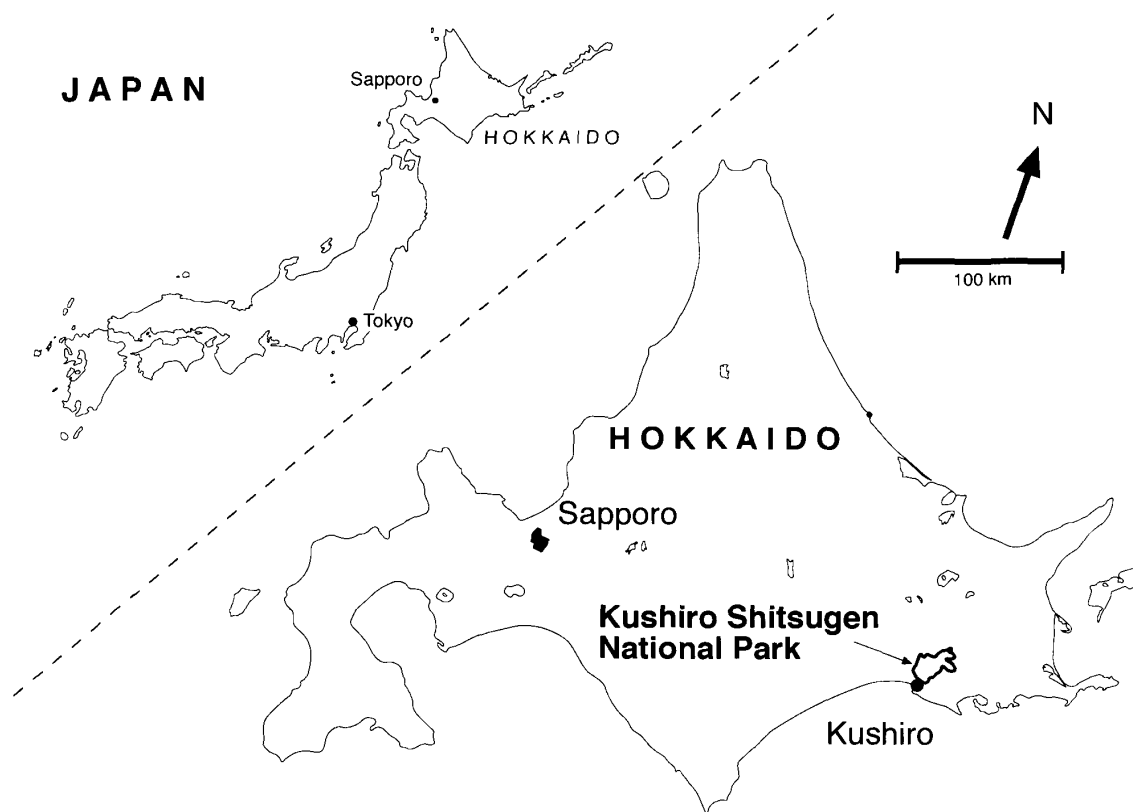


Fig. 1. Location map of Kushiro Shitsugen National Park.

being viewed using a JEOL JSM-5310 scanning electron microscope.

Terminology: CP, copulatory process; DL, dorsal lobe; DR, dorsal ridge; LR, lower claspings ramus; LV, left valve; MR, medial ridge; RV, right valve; UR, upper claspings ramus; ZY, zygum.

Systematics

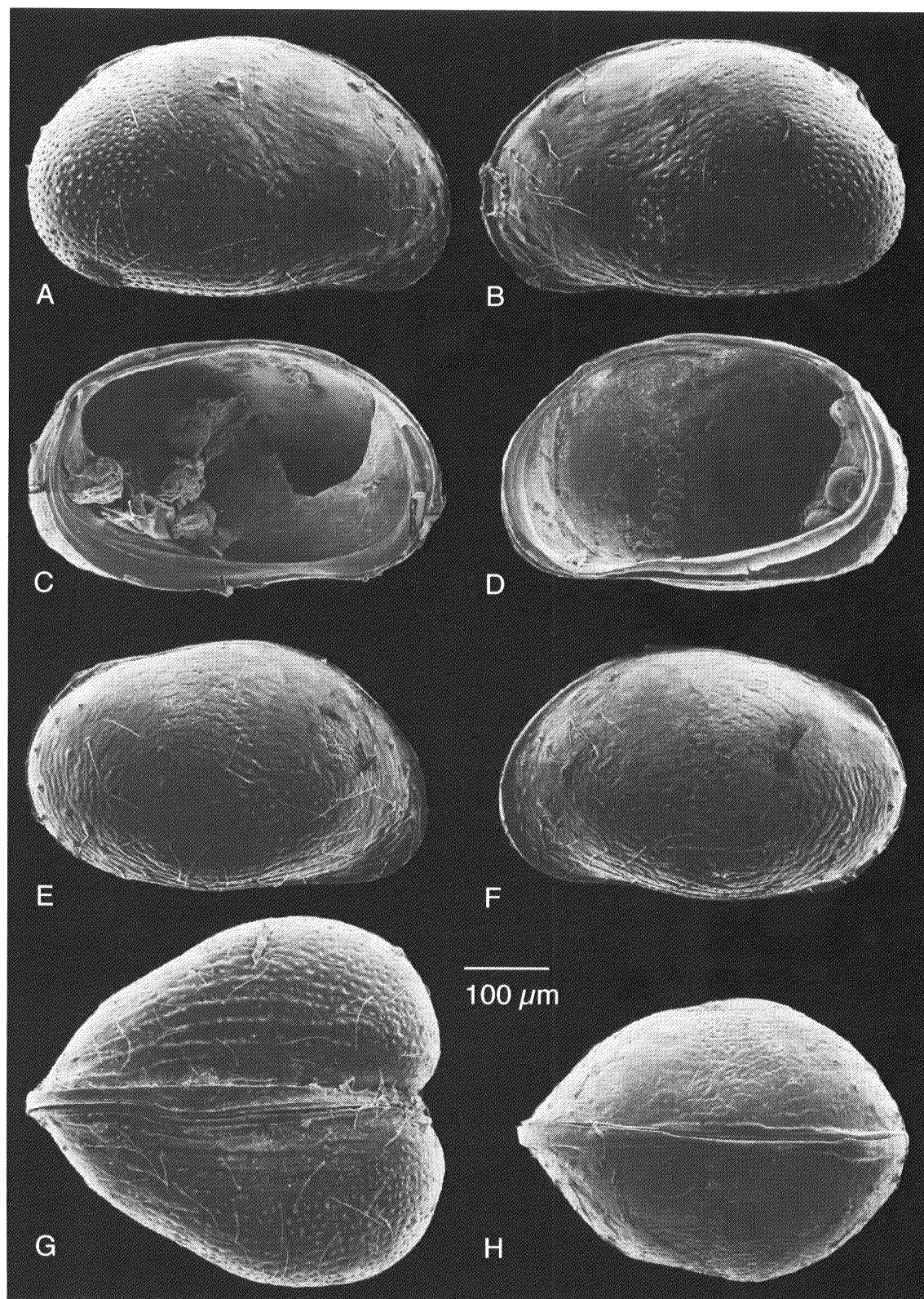
Genus *Metacypris* Brady and Robertson, 1870

Metacypris digitiformis sp. nov.

Metacypris cordata: Hiruta and Smith 2001: 111, 122, 124, fig. 15 K–L. [Nec Brady and Robertson, 1870]

Type material. All material was collected by R. J. Smith and S. Hiruta from

Fig. 2. *Metacypris digitiformis* sp. nov. A, external view of female right valve (paratype ZIHU 2068); B, external view of female left valve (paratype ZIHU 2068); C, internal view of female left valve (paratype ZIHU 2069); D, internal view of female right valve (paratype ZIHU 2069); E, external view of male right valve (paratype ZIHU 2072); F, external view of male left valve (paratype ZIHU 2072); G, ventral view of female carapace (paratype ZIHU 2070); H, ventral view of male carapace (paratype ZIHU 2073).



the type locality and is deposited in the Zoological Institute, Faculty of Science, Hokkaido University (ZIHU), Sapporo, Japan.

Holotype: male, ZIHU 2063, collected on 5 August 2001, with soft parts dissected in glycerine and sealed in a glass slide, and valves stored in a cavity slide. **Allotype:** female, ZIHU 2064, with soft parts dissected in glycerine and sealed in a glass slide, and valves stored in a cavity slide. **Paratypes:** ZIHU 2065, 2067, females, with soft parts dissected in glycerine and sealed in a glass slide, and 1 valve stored in a cavity slide, respectively; ZIHU 2066, 2068, 2069, females, with soft parts dissected in glycerine and sealed in a glass slide, and valves stored in a cavity slide, respectively; ZIHU 2070, female, whole carapace stored in a cavity slide; ZIHU 2071, male, with soft parts dissected in glycerine and sealed in a glass slide; ZIHU 2072, male, with soft parts dissected in glycerine and sealed in a glass slide, and valves stored in a cavity slide; ZIHU 2073, male, whole carapace stored in a cavity slide.

Type locality. Marshland in Kushiro Shitsugen National Park, Hokkaido, Japan (Fig. 1), 43°6'10"N; 144°20'30"E, near sea level in altitude. At the Onnenai Visitor Center an elevated wooden walkway (the Onnenai Trail) gives access to the marsh for sampling. The sampling site is known as "the old stream" and is situated about 550 m east of the Old Tsurui Road, which runs along the western edge of the marsh. Abundant specimens were recovered from the Onnenai Trail, at a depth of approximately 0.1 m. At time of sampling, pH=6.42.

Etymology. This species has a very distinctive digit-like plate (UR) on each hemipenis.

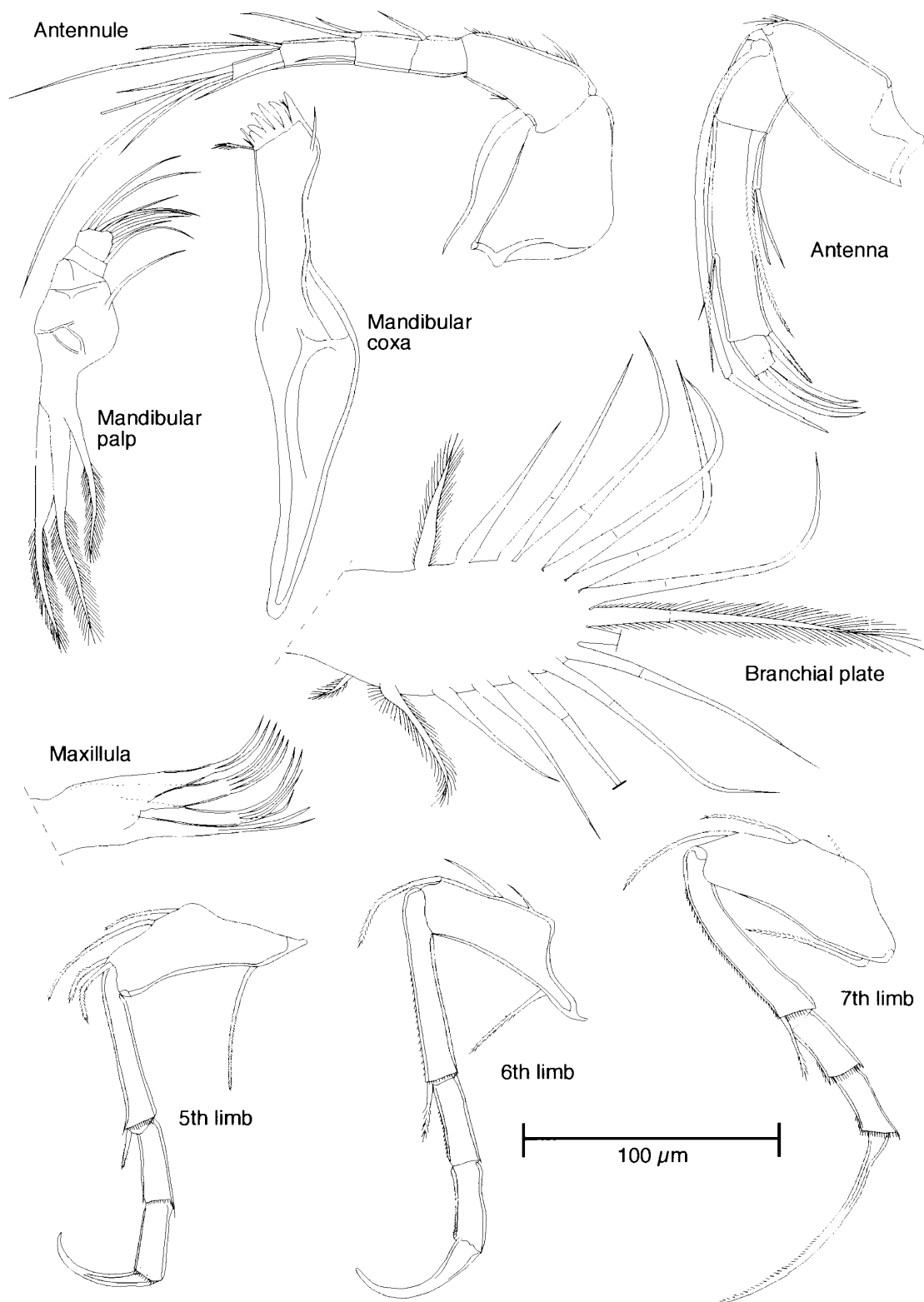
Diagnosis. Distinctive sexual dimorphism of carapace. Male carapace globular in dorsal view; central part of carapace inflated in lateral view. Width exceeding height. Female carapace with two large posterior brood chambers, producing heart-shaped dorsal view. Maxillula palp and endites elongate; palp reduced, with two long terminal setae. UR of hemipenis half length of DL and digitiform.

Description of male (holotype). Carapace (Figs 2, 5) 510 μ m long, 330 μ m high, width exceeding height. Globular in dorsal view with broad, transverse, dark green band behind eye. LV overlapping RV. In lateral view central part of carapace inflated, anterior margin rounded, and dorsal margin angular towards posterior. Hinge lophodont and curved. Maximum height just anterior of mid-length. Muscle scars with 4 elongate scars parallel to each other. Surface of carapace covered with small pits in central area, small ridges towards ventral and posterior margins, and tubercles in posterior and anterior areas.

Antennule slender, with 6 podomeres (Fig. 3). Second podomere with 1 stout ventral seta near proximal edge; 3rd podomere with 1 apical-dorsal seta; 4th podomere with 2 apical-dorsal and 1 apical-ventral setae; 5th podomere with 3 apical-dorsal and 1 apical-ventral setae; final podomere with 3 setae and 1 aesthetasc.

Antenna slender, with 4 podomeres. Spinneret seta (exopodite) 2-segmented, long and thin, reaching to end of limb. Seta on apical-ventral corner of 2nd podomere as long as 3rd podomere. Third podomere elongate, with 2 dorsal setae of

Fig. 3. Appendages of *Metacypris digitiformis* sp. nov. Antennule (female, paratype ZIHU 2066), antenna (female, paratype ZIHU 2065), mandibular palp (female, allotype ZIHU 2064), mandibular coxa (female, paratype ZIHU 2065), maxillula (female, paratype ZIHU 2066), branchial plate (female, paratype ZIHU 2067), fifth limb (male, paratype ZIHU 2071), sixth limb (female, paratype ZIHU 2066), seventh limb (female, paratype ZIHU 2066).



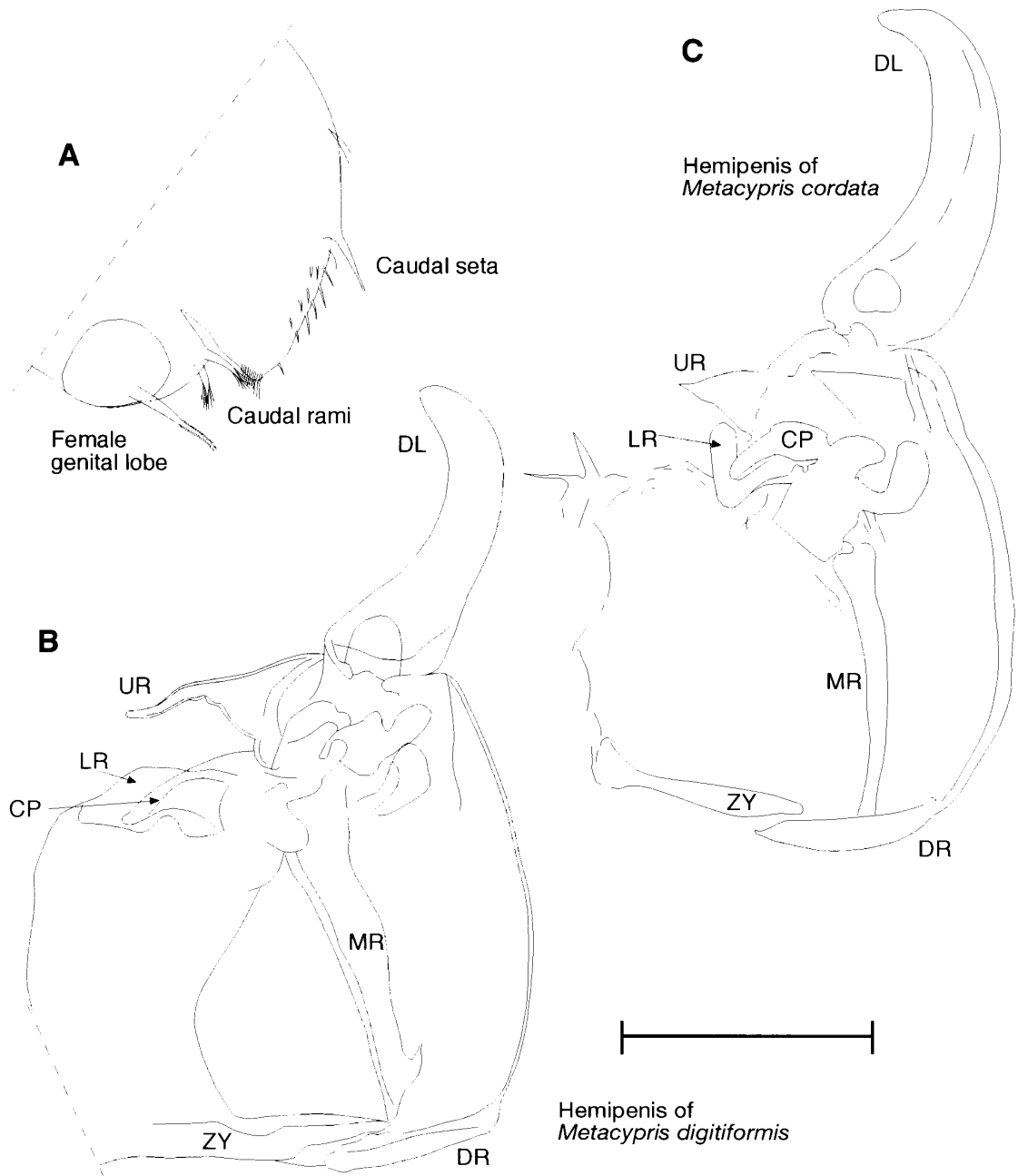


Fig. 4. Genital structure of *Metacypris* spp. A, female genital lobe of *M. digitiformis* (allotype ZIHU 2064); B, hemipenis of *M. digitiformis* (holotype ZIHU 2063); C, hemipenis of *M. cordata* (modified from Danielopol and Horne 1996). Scale bar=100 μ m for A and B; scale of C unknown.

different lengths on setiferous ledge, 2 ventral setae of subequal lengths (1=aes-thetasc?) on setiferous ledge, and 1 apical-ventral stout seta. Final podomere with 2 apical claws of approximately equal length and 1 subapical claw.

Mandibular coxa elongate, with 7 teeth (Fig. 3). Mandibular palp small and stout, with indistinct segmentation, terminating with 7 setae. Branchial plate elongate, with 3 setae, one shorter than others.

Maxillula palp unsegmented and reduced, terminating with 2 long setae (Fig. 3). Endites elongate, 3rd and 2nd endites terminating with 4 setae each and 1st endite terminating with 2 setae. Branchial plate with 15 long setae and 1 short seta (=reflexed seta?).

Fifth limb with 4 podomeres (Fig. 3). First podomere with 2 setae on dorsal edge, 1 seta on ventral edge, and 2 setae on apical-dorsal corner. Second podomere most elongate and terminating with 1 apical-dorsal seta. Final podomere with short, stout, strongly curved claw. Sixth and 7th limbs with similar chaetotaxal arrangement as 5th limb but with only 1 apical-dorsal seta on 1st podomere (Fig. 3). Claw of 7th limb approximately twice as long as other claws.

Hemipenis large and symmetrical (Fig. 4). DL long and curved; LR broad, with indentation along one edge. CP stout and curved. UR long, about half length of DL, and digitiform distally.

Description of female. Carapace differing from that of male in having very inflated brood chambers producing heart shape in dorsal view (Figs 2, 5). Ten or 11 eggs/A-8 instars present in each brood chamber. Maximum width at approximately one quarter length from posterior end, width/length ratio ranging from 0.92 to 0.94.

Appendages similar to those of male. Genital lobe rounded, with 1 seta (Fig. 4). Caudal rami small, each consisting of 2 short setae. Posterior of abdomen rounded and covered with tiny spines. Caudal seta short and smooth.

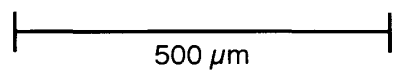
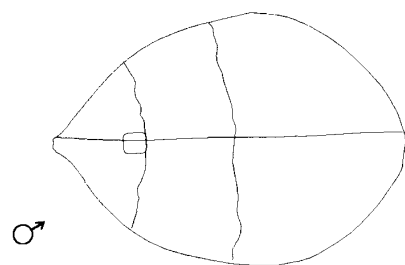
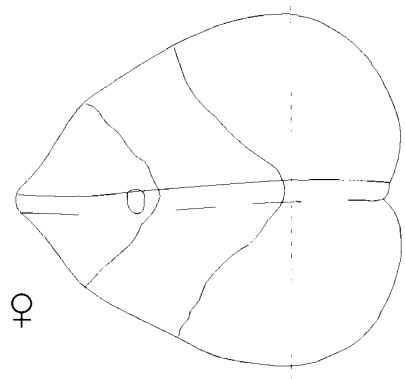
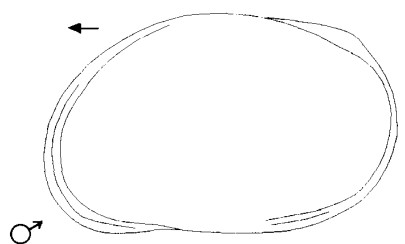
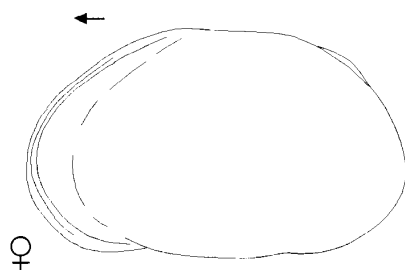
Measurements. Length: males 460–510 μm , females 500–530 μm . Height: males 320–330 μm , females 320–360 μm . Width: males 340–345 μm , females 465–480 μm .

Discussion

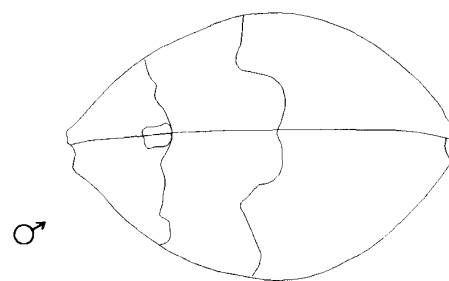
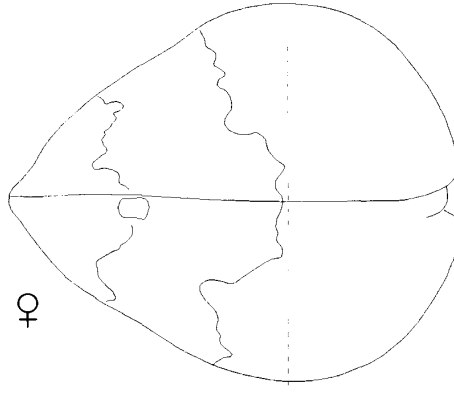
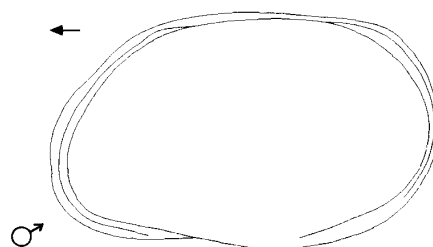
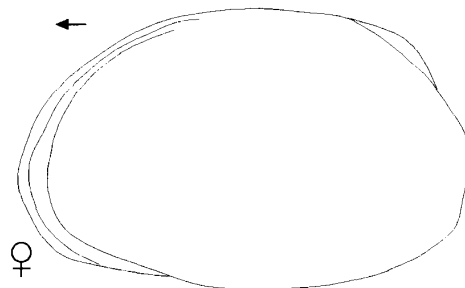
Similar species

Of the living and fossil species assigned to the genus *Metacypris*, this species is most similar to the living species *Metacypris cordata*. Differences include the female brood chambers, which are more inflated in *M. digitiformis* than in *M. cordata*, giving *M. digitiformis* a more distinctive heart shape in dorsal view (Fig. 5). The inflated brood chambers of females of *M. digitiformis* place the level of maximum width significantly farther posteriorly than in females of *M. cordata*. A maximum of six or seven eggs is present in each brood chamber of *M. cordata* (Colin and Danielopol 1980; Danielopol *et al.* 1996), whereas *M. digitiformis* has 10 or 11 eggs and/or A-8 instars in each brood chamber. Additionally, the posterior part and the anterior margin of the carapace in *M. digitiformis* are more rounded than in *M. cordata*. *Metacypris digitiformis* is slightly smaller than *M. cordata*. The carapace of *M. cordata* is covered with many foveolae, whereas foveolae are absent anteriorly in *M. digitiformis*. The inner seta of the first endopodal segment on the antenna reaches to the last podomere in *M. digitiformis*, whereas this seta is much shorter in *M. cordata*. The male hemipenis of *M. digitiformis* has a UR that is proportionally twice as long as that of *M. cordata* (Fig. 4), and is different in shape. Additionally, the LR of the hemipenis of *M. cordata* is bent more than 90°, while that of *M. digitiformis* is broader and straight (Fig. 4).

***Metacypris digitiformis* sp. nov.**



***Metacypris cordata*
Brady and Robertson, 1870**



Redrawn from Meisch (2000)

Fig. 5. Outlines of the carapace of *Metacypris digitiformis* sp. nov. and *Metacypris cordata*.

Ecology and life history

Metacypris digitiformis lives among the littoral vegetation in lentic pools of the marsh. It was only found at the type locality, where the pH was almost neutral (6.42). Other sites in the immediate area with a lower pH (just over 5) yielded no specimens of *M. digitiformis*. A sample collected on 22 July 2000 consisted of 72% adult females, 14% adult males, and 14% juveniles (total of 171 specimens). All females had abundant eggs and A-8 instars in their brood chambers. Two other samples (taken by Mr. M. Homma, Hokkaido University of Education) on 22 September and 27 October 1999 yielded no males, although the females of the September sample bore eggs. This indicates that the summer months are the main breeding season for this species and adult males may only be present then, similar to the case for *M. cordata* (Danielopol *et al.* 1996). Co-occurring species at the type locality are *Cyclocypris ovum* (Jurine, 1820) (Hiruta and Smith 2001) and *Cyclocypris diebeli* Absolon, 1973 (Matzke-Karasz *et al.* in press).

Biogeography

This record of a living *Metacypris* species is the first outside Europe. It is only the second record of a freshwater cytheroidean ostracod in Hokkaido, the first being the entocytherid ostracod *Uncinocythere occidentalis* (Kozloff and Whitman, 1954) (Smith and Kamiya 2001). Since *U. occidentalis* is a commensal species on the invasive signal crayfish [*Pacifastacus leniusculus* (Dana, 1852)], it is highly likely that it too is an invasive species and not native to Japan (Smith and Kamiya 2001). The present record of *Metacypris* thus represents the first endemic species of freshwater cytheroidean ostracod from Hokkaido. One other freshwater cytheroidean species has been recorded from Japan, *Cytherissa lacustris* (Sars, 1863) from Lake Aoki, Nagano Prefecture (Brehm 1927), but *Metacypris digitiformis* represents the first record of the family Limnocytheridae (the largest family of non-marine Cytheroidea) in Japan.

Acknowledgments

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